

High Specific Power Multiple-Cylinder Free-Piston Alpha Stirling, Phase I

Completed Technology Project (2006 - 2006)



Project Introduction

NASA seeks highly efficient, long life solar dynamic power conversion systems. The requirements for these missions emphasize low mass and high conversion efficiencies. A reliable and highly efficient Stirling convertor would provide mission planners with less costly spacecraft power options than currently exist. Current Stirling technologies have demonstrated a beginning of life specific power level of 4.2 W/kg, and a useful life greater than 10 years. The proposed effort will result in the preliminary design for an innovative multiple-cylinder alpha free-piston Stirling engine (AFPSE) for high power applications. The program approach minimizes development risk by combining proven technologies, experiences and innovative concepts of Sunpower Inc. and Global Cooling BV (GCBV) with AFPSE. The proposed system is a compact, highly efficient, long life, low mass Stirling machine for a high power conversion system. This configuration having multi-pistons in separate cylinders connected by rejector and acceptor is not only very simple due to one moving part in one cylinder with no displacer, but also highly adaptable due to its versatile shape. This machine is very innovative because it is anticipated to achieve a specific power greater than 100W/kg as well as a heat input to electrical output conversion efficiency greater than 30%.

Anticipated Benefits

Potential NASA Commercial Applications: In addition to the space applications which this proposal directly addresses, there is a significant potential market for commercial small-scale power generation, particularly in light of increasing attention to the environmental cost of fuel consumption and the new stringency of fuel emissions regulations in some areas of the world. Sunpower licensee MicroGen, for example, has determined a substantial European and worldwide market for household cogeneration devices. Additionally there are numerous opportunities for remote and mobile power generation applications, including the marine market, auxiliary power markets, remote power generation, standby emergency power generation, peaking generation, truck-mounted power, power for oil and gas fields and other exploratory and off-grid sites.



High Specific Power Multiple-Cylinder Free-Piston Alpha Stirling, Phase I

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Organizational Responsibility	1
Primary U.S. Work Locations and Key Partners	2
Project Management	2
Technology Areas	2

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

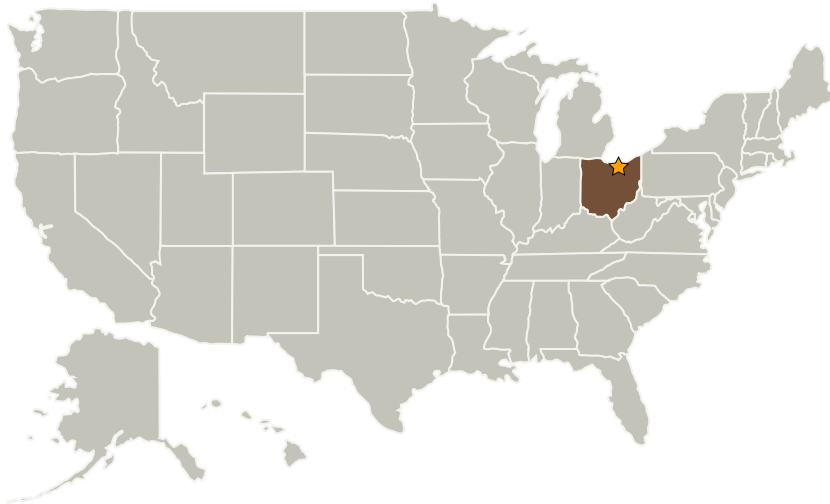
Small Business Innovation Research/Small Business Tech Transfer

High Specific Power Multiple-Cylinder Free-Piston Alpha Stirling, Phase I

Completed Technology Project (2006 - 2006)



Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Sunpower, Inc.	Supporting Organization	Industry	Athens, Ohio

Primary U.S. Work Locations

Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Seon-young Y Kim

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.1 Power Generation and Energy Conversion
 - └ TX03.1.4 Dynamic Energy Conversion